Munich Cancer Registry

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ICD-10 C21: Anal cancer

Incidence and Mortality

Year of diagnosis	1998-2014
Patients	1,292
Diseases	1,292
Creation date	04/13/2016
Export date	12/23/2015
Population	4.64 m

Munich Cancer Registry at Munich Cancer Center
Marchioninistr. 15
Munich, 81377
Germany

http://www.tumorregister-muenchen.de/en

http://www.tumorregister-muenchen.de/en/facts/base/bC21__E-ICD-10-C21-Anal-cancer-incidence-and-mortality.pdf

Global Statements about the statistics on the Internet −
Baseline Statistics (grey button), **Survival** (red button)

In these analyses, the clinics and physicians of Upper Bavaria and the city and county of Landshut[#], with a total of 4.64 million inhabitants, account for the frequency of cancer diseases[##] and the achieved long term results. Additionally, the long term survival evaluated by the Munich Cancer Registry (MCR) is compared with the results of the population-based registry in the USA (SEER), which is useful for checking the consistency of the data on an international level.

In comparing several tables, inconsistent figures may be detected. This is based on the fact that different patient cohorts are included in the base calculation, for example when proportions of multiple tumors or DCO-cases[###] are concerned. In other cases the individual tumor diagnosis is the basis for calculation, for example with incidence.

The foot notes describe the currentness of the data. The baseline statistics and survival data are updated annually. This yearly analysis comprises the Annual Report of the MCR.

Clinics and physicians have access to essentially more detailed data, with which they can check, compare and in the best case optimize their own data and results.

We would be pleased to receive corrections, critique and useful suggestions. Just send an e-mail to tumor@ibe.med.uni-muenchen.de.

Munich Cancer Registry, April 2016

[#] Base data has been collected since 1998. An increase in new diseases is apparent, which is an effect of two extensions in the MCR catchment area (from a base population of 2.51 million to 3.96 in 2002, and to 4.52 million in 2007).

[##] Due to the high frequency and good prognosis of non-malignant skin cancer (C44), no systematic ascertainment is performed for this diagnosis. C44 is not designated as a primary, but rather as a secondary tumor.

[###] DCO (death certificate only) identifies a cancer case that first becomes available to the MCR through the death certificate.

ICD-10 codes (ICD-10 2015) used for specifying cancer site

Code	Description
C21.-	Malignant neoplasm of anus and anal canal
C21.0	Anus, unspecified
C21.1	Anal canal
C21.2	Cloacogenic zone
C21.8	Overlapping lesion of rectum, anus and anal canal

INCIDENCE

Table 1

All patients with invasive cancer by year of diagnosis, proportions of DCO, multiple primaries, deaths, and active follow-up (incl. DCO)

Year of diagnosis	Cases n	DCO cases n	Prop. DCO %	Prop. mult. primaries %	Prop. deaths %	Prop. actively followed %
1998	45			22.2	62.2	97.8
1999	33	3	9.1	18.2	60.6	97.0
2000	41			29.3	65.9	97.6
2001	56	3	5.4	25.0	62.5	94.6
2002	65	2	3.1	32.3	67.7	98.5 #
2003	67	1	1.5	25.4	44.8	92.5
2004	71	3	4.2	28.2	39.4	97.2
2005	76	1	1.3	39.5	57.9	94.7
2006	80	4	5.0	33.8	50.0	93.8
2007	94	4	4.3	31.9	53.2	78.7 #
2008	87	1	1.1	23.0	47.1	79.3
2009	111	1	0.9	32.4	38.7	76.6
2010	117	6	5.1	29.9	47.0	76.1
2011	102	1	1.0	22.5	34.3	75.5
2012	105			27.6	31.4	78.1
2013	90			36.7	16.7	98.9
2014	52	4	7.7	26.9	19.2	98.1 ##
1998-2014	1292	34	2.6	29.2	44.7	87.2

The increases of incident cases in 2002 and 2007 reflect the expansion to additional registry areas.

Please be aware that data of recent annual patient cohorts may not yet be fully processed. The years under evaluation can be found in the respective headings.

Table 1a

All patients with invasive cancer
by year of diagnosis and gender
(incl. DCO)

Year of diagnosis	All n	Males n	Females n	Prop. males %
1998	45	14	31	31.1
1999	33	10	23	30.3
2000	41	11	30	26.8
2001	56	21	35	37.5
2002	65	16	49	24.6
2003	67	21	46	31.3
2004	71	16	55	22.5
2005	76	16	60	21.1
2006	80	26	54	32.5
2007	94	34	60	36.2
2008	87	27	60	31.0
2009	111	41	70	36.9
2010	117	38	79	32.5
2011	102	41	61	40.2
2012	105	29	76	27.6
2013	90	35	55	38.9
2014	52	18	34	34.6
1998-2014	1292	414	878	32.0

Table 2

Incidence measures by year of diagnosis including DCO cases
(with respect to registry area expansion from 2.51 to 3.96 m as of 2002,
and from 3.96 to 4.64 m as of 2007, respectively)

Year of diagnosis	Males n	Females n	Males Inc. raw	Fem. Inc. raw	Males Inc. WS	Fem. Inc. WS	Males Inc. ES	Fem. Inc. ES	Males Inc. BRD-S	Fem. Inc. BRD-S
1998	14	31	1.3	2.6	0.8	1.4	1.1	1.9	1.4	2.3
1999	10	23	0.9	1.9	0.5	0.9	0.8	1.3	1.0	1.5
2000	11	30	1.0	2.5	0.6	1.4	0.8	1.9	1.0	2.1
2001	21	35	1.8	2.9	1.0	1.4	1.5	2.1	1.8	2.4
2002	16	49	0.9	2.5	0.5	1.3	0.8	1.8	0.9	2.1
2003	21	46	1.1	2.3	0.7	1.3	1.0	1.7	1.1	2.0
2004	16	55	0.9	2.8	0.5	1.4	0.7	1.9	0.9	2.4
2005	16	60	0.8	3.0	0.5	1.4	0.7	2.0	0.9	2.6
2006	26	54	1.4	2.7	0.8	1.5	1.1	2.1	1.2	2.3
2007	34	60	1.5	2.6	0.9	1.2	1.3	1.7	1.5	2.1
2008	27	60	1.2	2.6	0.7	1.2	1.0	1.7	1.1	2.1
2009	41	70	1.8	3.0	1.1	1.7	1.5	2.3	1.7	2.6
2010	38	79	1.7	3.4	0.8	1.6	1.2	2.3	1.6	2.8
2011	41	61	1.8	2.6	1.0	1.4	1.4	1.9	1.7	2.2
2012	29	76	1.3	3.2	0.6	1.6	0.9	2.3	1.2	2.6
2013	35	55	1.5	2.3	0.9	1.1	1.2	1.7	1.4	1.9
2014	18	34	0.8	1.4	0.4	0.8	0.6	1.1	0.7	1.2
1998-2014	414	878	1.3	2.6	0.7	1.3	1.1	1.9	1.3	2.2

The computation of the incidence measures includes all primaries, irrespective of first or subsequent malignancy.

Table 3

Age distribution parameters by year of diagnosis (All patients)
(incl. DCO)

Year of diagnosis	Cases n	Mean	Std. dev.	Min.	Max.	10%	25%	Median 50%	75%	90%
1998	45	64.2	14.7	34.3	90.7	48.1	52.1	61.7	78.2	84.5
1999	33	66.9	18.2	30.8	94.8	39.4	56.3	67.0	81.9	89.8
2000	41	63.0	11.8	34.7	89.8	51.4	56.1	62.1	70.8	79.8
2001	56	64.6	15.2	35.3	92.5	43.4	54.9	62.6	77.8	85.5
2002	65	66.2	12.6	41.6	89.2	51.4	57.3	63.2	76.5	84.0
2003	67	62.4	15.4	35.2	91.9	41.9	49.4	62.7	74.4	85.6
2004	71	65.7	14.4	28.1	95.9	47.0	54.6	65.5	78.6	82.8
2005	76	67.7	12.9	32.2	91.7	47.8	59.7	68.8	78.6	83.2
2006	80	63.4	13.1	28.5	93.2	45.0	54.3	63.6	70.2	82.6
2007	94	67.8	14.7	28.6	94.9	47.2	56.5	68.1	80.0	87.2
2008	87	66.4	14.0	33.6	93.9	46.2	57.1	67.9	75.8	85.7
2009	111	63.6	13.5	23.8	102	47.1	54.1	64.0	72.0	81.6
2010	117	67.8	13.6	36.9	94.4	49.1	58.0	69.1	77.6	86.0
2011	102	64.5	13.5	22.8	101	47.4	54.7	63.0	74.0	82.3
2012	105	67.8	14.5	37.2	96.5	49.3	55.3	68.8	80.5	86.5
2013	90	65.4	14.0	32.1	94.0	46.9	55.1	64.6	76.4	85.1
2014	52	64.2	16.6	1.4	93.5	41.5	55.3	66.1	74.4	83.5
1998-2014	1292	65.6	14.2	1.4	102	47.1	55.2	65.4	76.6	84.7

Table 3a

Age distribution parameters by year of diagnosis (MALES)
(incl. DCO)

Year of diagnosis	Cases n	Mean	Std. dev.	Min.	Max.	10%	25%	Median 50%	75%	90%
1998	14	57.6	14.5	34.3	84.5	35.6	48.4	56.7	64.2	78.5
1999	10	63.4	18.4	30.8	86.7	33.7	54.9	66.0	77.6	85.4
2000	11	62.8	9.8	50.8	82.4	53.2	54.3	62.1	72.3	72.7
2001	21	61.6	13.2	37.4	82.1	42.8	56.4	61.8	66.8	79.3
2002	16	64.9	10.0	51.4	79.9	52.5	56.9	63.0	74.8	79.5
2003	21	60.3	13.5	35.2	85.9	41.3	51.2	59.0	69.5	76.3
2004	16	59.2	17.0	28.1	82.8	40.8	44.8	55.5	74.6	81.2
2005	16	63.3	10.0	47.8	82.6	50.6	58.8	61.7	69.7	80.3
2006	26	61.5	11.4	38.6	84.6	43.5	54.2	63.6	67.1	74.1
2007	34	66.2	13.4	45.4	93.9	47.5	56.1	65.7	78.8	87.2
2008	27	61.7	11.8	36.9	76.9	43.9	53.0	61.7	73.4	75.7
2009	41	63.3	13.3	37.5	102	46.3	54.1	65.5	70.0	77.8
2010	38	68.3	12.8	42.4	93.5	49.1	58.0	70.6	78.0	83.3
2011	41	64.1	12.6	33.3	89.4	49.6	54.5	63.8	74.1	79.1
2012	29	72.6	13.3	47.4	96.5	54.8	62.9	73.8	82.2	91.6
2013	35	63.6	14.2	32.1	88.4	44.9	52.0	63.6	73.2	81.9
2014	18	63.0	12.7	40.1	84.1	41.5	52.0	66.1	71.1	80.9
1998-2014	414	64.0	13.3	28.1	102	45.8	54.6	64.2	73.5	81.1

Table 3b

Age distribution parameters by year of diagnosis (FEMALES)
(incl. DCO)

Year of diagnosis	Cases n	Mean	Std. dev.	Min.	Max.	10%	25%	Median 50%	75%	90%
1998	31	67.1	14.0	44.6	90.7	49.5	57.1	65.9	78.6	85.7
1999	23	68.4	18.3	34.3	94.8	40.1	56.3	70.7	85.6	90.2
2000	30	63.2	12.6	34.7	89.8	49.4	56.1	62.8	70.8	80.6
2001	35	66.3	16.2	35.3	92.5	45.0	52.6	65.4	82.5	87.9
2002	49	66.6	13.4	41.6	89.2	48.9	58.8	64.4	76.8	87.3
2003	46	63.4	16.2	36.1	91.9	42.7	49.4	62.9	76.7	86.8
2004	55	67.7	13.2	39.6	95.9	49.0	58.1	66.5	79.7	83.2
2005	60	68.9	13.4	32.2	91.7	46.3	62.3	70.8	79.3	84.0
2006	54	64.4	13.8	28.5	93.2	49.0	54.4	64.0	77.5	83.6
2007	60	68.8	15.4	28.6	94.9	44.5	58.3	70.7	80.3	87.2
2008	60	68.5	14.5	33.6	93.9	47.9	58.3	68.9	80.2	86.9
2009	70	63.8	13.7	23.8	88.9	47.2	54.4	63.0	73.1	83.7
2010	79	67.6	14.0	36.9	94.4	48.1	57.5	67.0	76.8	87.1
2011	61	64.8	14.2	22.8	101	47.4	55.6	62.3	72.8	83.4
2012	76	66.0	14.5	37.2	92.5	49.2	53.6	64.3	79.3	86.0
2013	55	66.6	13.8	39.2	94.0	49.4	55.5	65.8	76.6	86.8
2014	34	64.8	18.5	1.4	93.5	40.1	56.6	66.4	76.7	86.3
1998-2014	878	66.4	14.5	1.4	101	47.4	55.6	66.5	77.9	85.8

Table 4

Age distribution by 5-year age group and gender for period 2007-2014
(incl. DCO)

Age at diagnosis Years	Cases n	%	Cum.%	Males n	%	Cum.%	Females n	%	Cum.%
0-4	1	0.1	0.1			0.0	1	0.2	0.2
5-9	0	0.0	0.1			0.0			0.2
10-14	0	0.0	0.1			0.0			0.2
15-19	0	0.0	0.1			0.0			0.2
20-24	2	0.3	0.4			0.0	2	0.4	0.6
25-29	1	0.1	0.5			0.0	1	0.2	0.8
30-34	4	0.5	1.1	2	0.8	0.8	2	0.4	1.2
35-39	12	1.6	2.6	4	1.5	2.3	8	1.6	2.8
40-44	30	4.0	6.6	10	3.8	6.1	20	4.0	6.9
45-49	55	7.3	13.9	21	8.0	14.1	34	6.9	13.7
50-54	79	10.4	24.3	27	10.3	24.3	52	10.5	24.2
55-59	86	11.3	35.6	33	12.5	36.9	53	10.7	34.9
60-64	84	11.1	46.7	23	8.7	45.6	61	12.3	47.3
65-69	96	12.7	59.4	41	15.6	61.2	55	11.1	58.4
70-74	89	11.7	71.1	36	13.7	74.9	53	10.7	69.1
75-79	81	10.7	81.8	31	11.8	86.7	50	10.1	79.2
80-84	60	7.9	89.7	19	7.2	93.9	41	8.3	87.5
85+	78	10.3	100.0	16	6.1	100.0	62	12.5	100.0
All ages	758	100.0		263	100.0		495	100.0	

Included in the statistics are 36.5% multiple primaries in males and 40.6% in females.

Table 5

Age-specific incidence, DCO rate and proportion of all cancers
for period 2007-2014

Age at diagnosis Years	Males n	Females n	Males Age-spec. incid.	Females Age-spec. incid.	Males DCO rate n=4 %	Females DCO rate n=13 %	Males Prop.all cancers n=91183 %	Females Prop.all cancers n=89596 %
0- 4		1	0.0	0.1		100.0		0.7
5- 9			0.0	0.0				
10-14			0.0	0.0				
15-19			0.0	0.0				
20-24		2	0.0	0.2				0.6
25-29		1	0.0	0.1				0.2
30-34	2	2	0.2	0.2			0.3	0.2
35-39	4	8	0.3	0.6			0.3	0.4
40-44	10	20	0.6	1.3			0.5	0.5
45-49	21	34	1.3	2.2			0.7	0.6
50-54	27	52	2.1	4.1			0.6	0.8
55-59	33	53	3.1	4.7			0.5	0.7
60-64	23	61	2.3	5.8			0.2	0.7
65-69	41	55	4.3	5.3	2.4		0.3	0.5
70-74	36	53	4.0	5.1	2.8		0.2	0.4
75-79	31	50	5.6	7.0	6.5		0.2	0.5
80-84	19	41	5.4	7.3		9.8	0.2	0.5
85+	16	62	6.9	10.7		12.9	0.3	0.6
All ages	263	495			1.5	2.6	0.3	0.6
Incidence								
Raw			1.5	2.6				
WS			0.8	1.3				
ES			1.1	1.9				
BRD-S			1.4	2.2				

The age-specific incidence characterizes the disease risk in a particular age group. The age distribution depends on the patient population frequency in each age group and reflects the tangible clinical picture of everyday patients care (see following chart).

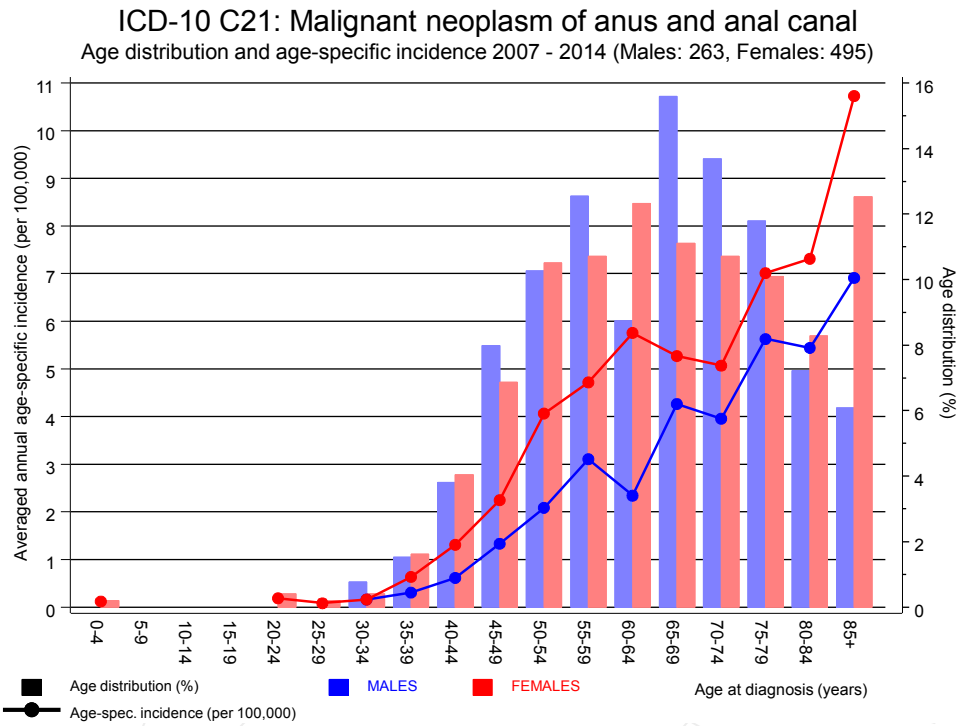


Figure 6. Age distribution and age-specific incidence

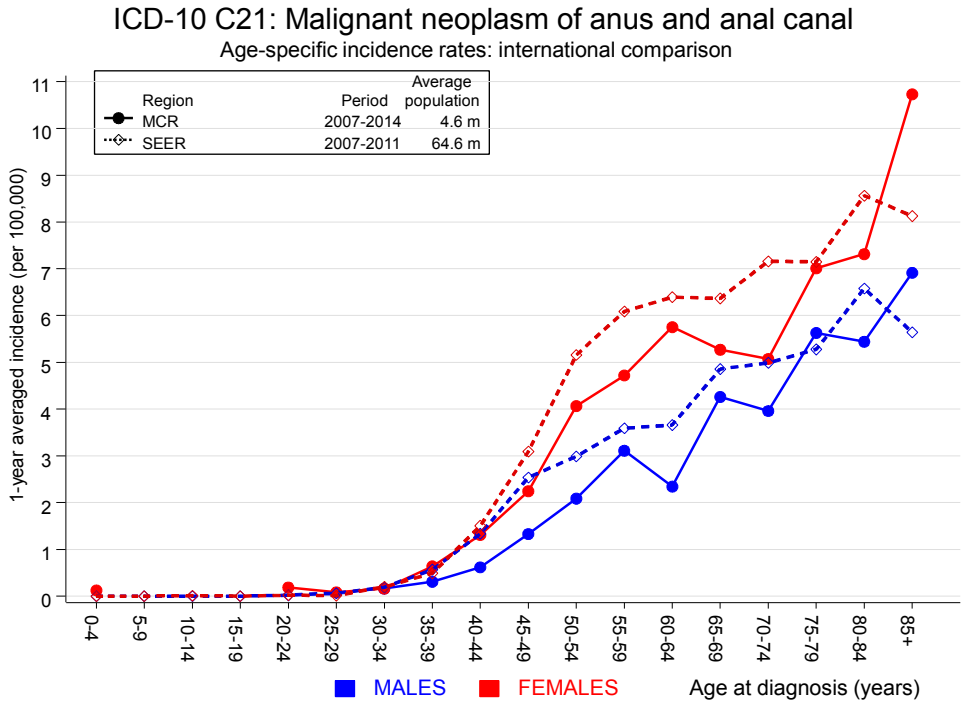


Figure 6a. Age-specific incidence in MCR registry areas compared to SEER (Surveillance, Epidemiology, and End Results, USA).

Reference:

Surveillance, Epidemiology, and End Results (SEER) Program SEER*Stat Database: Incidence - SEER 18 Regs Research Data, released April 2014, based on the November 2013 submission. http://www.seer.cancer.gov.

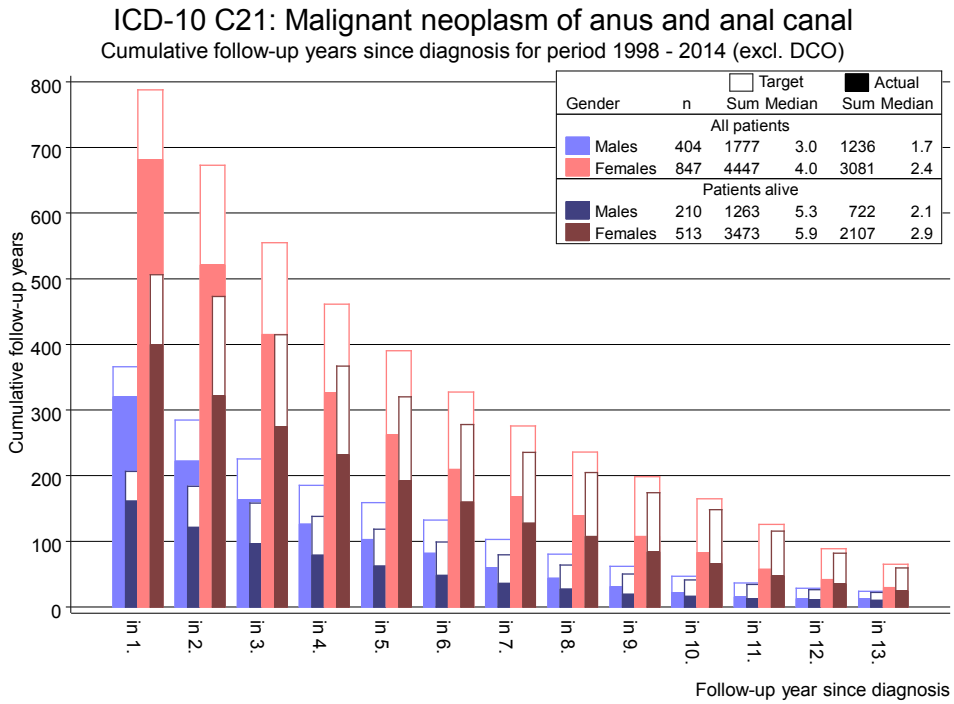


Figure 7. Cumulative follow-up years depending on time since diagnosis

The increase of the lost to follow-up rate can be interpreted as a consequence of a declining number of survivors over time.

Table 8a

Standardized incidence ratio (SIR, with 95% confidence limits), excess absolute risk (EAR) and DCO rate of second primaries for period 1998-2014
MALES

Diagnosis		Observed n	Expected n	SIR	LCL 95%	UCL 95%		EAR	DCO %
C09-C10	Oropharynx	2	0.2	9.7	1.2	34.9	#	14.6	
C16	Stomach	4	0.7	5.6	1.5	14.4	#	26.7	25.0
C18	Colon	4	1.7	2.4	0.6	6.1		18.8	25.0
C19-C20	Rectum	4	1.0	4.1	1.1	10.6	#	24.6	
C33-C34	Lung	10	2.1	4.8	2.3	8.9	#	64.4	
C61	Prostate	9	5.1	1.8	0.8	3.3		31.6	
Other primaries		13	4.2	3.1	1.7	5.3	#	71.7	
Not observed		0	2.9	0.0	0.0	1.3		-23.7	
All mult. primaries		46	17.9	2.6	1.9	3.4	#	228.7	4.3

Patients	408
Median age at second malignancy (years)	66.0
Person-years	1231
Mean observation time (years)	3.0
Median observation time (years)	1.7

The occurrence of second malignancy is statistically significant.

Observed second primaries with count 1 are pooled in category “Other primaries”

Table 8b

Standardized incidence ratio (SIR, with 95% confidence limits), excess absolute risk (EAR) and DCO rate of second primaries for period 1998-2014
FEMALES

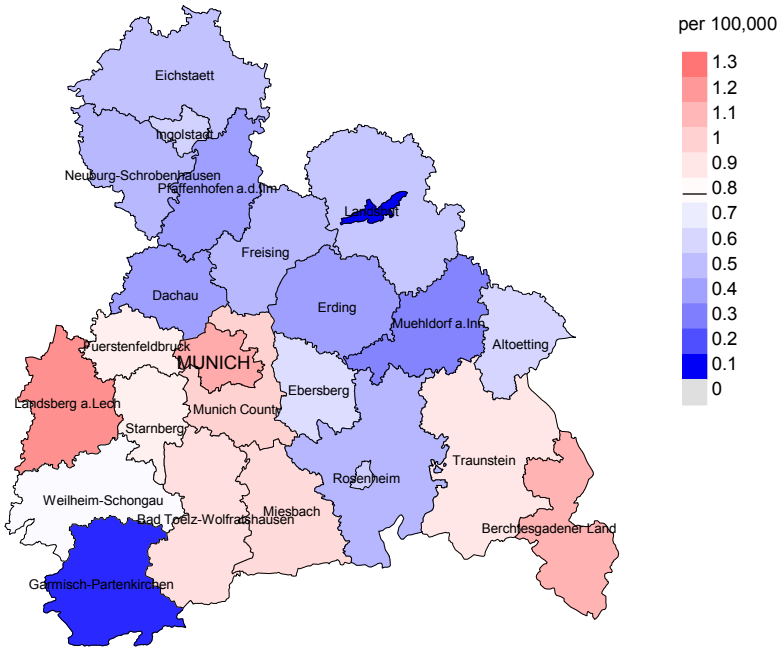
Diagnosis		Observed n	Expected n	SIR	LCL 95%	UCL 95%		EAR	DCO %
C16	Stomach	3	1.2	2.5	0.5	7.5		5.9	
C17	Small intestine	2	0.2	12.4	1.5	44.8	#	6.0	
C18	Colon	13	3.3	4.0	2.1	6.8	#	31.6	38.5
C19-C20	Rectum	5	1.4	3.6	1.2	8.3	#	11.7	
C25	Pancreas	2	1.5	1.4	0.2	4.9		1.7	
C33-C34	Lung	20	2.4	8.3	5.0	12.8	#	57.1	5.0
C43	Malign. melanoma	2	1.3	1.6	0.2	5.8		2.4	
C50	Breast	19	10.3	1.8	1.1	2.9	#	28.2	5.3
C51	Vulva	4	0.3	11.9	3.2	30.5	#	11.9	
C53	Cervix uteri	3	0.5	6.5	1.3	19.1	#	8.3	33.3
C54	Corpus uteri	3	1.9	1.6	0.3	4.7		3.7	
C56	Ovary	2	1.4	1.5	0.2	5.3		2.1	
C67	Bladder	2	0.6	3.2	0.4	11.5		4.5	
C73	Thyroid	3	0.6	5.0	1.0	14.8	#	7.8	
C82-C85	NHL	5	1.3	3.9	1.3	9.1	#	12.1	
C91-C96	Leukaemia	3	0.5	5.6	1.2	16.4	#	8.0	33.3
Other primaries		9	3.0	3.0	1.4	5.7	#	19.4	11.1
Not observed		0	2.1	0.0	0.0	1.7		-7.0	
All mult. primaries		100	33.7	3.0	2.4	3.6	#	215.4	10.0

Patients	856
Median age at second malignancy (years)	69.8
Person-years	3078
Mean observation time (years)	3.6
Median observation time (years)	2.4

The occurrence of second malignancy is statistically significant.

Observed second primaries with count 1 are pooled in category “Other primaries”

Average incidence (world standard population) 2007 - 2014: Males



Average incidence (world standard population) 2007 - 2014: Females

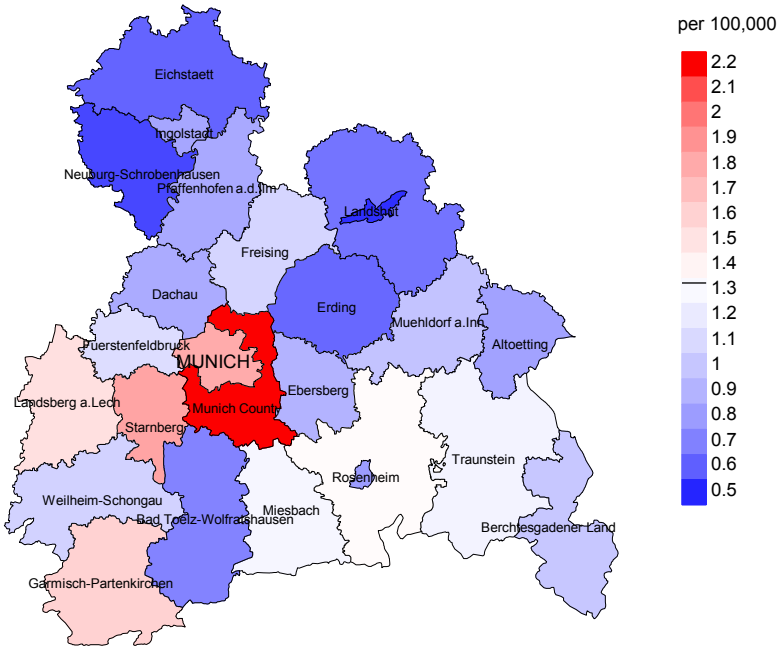
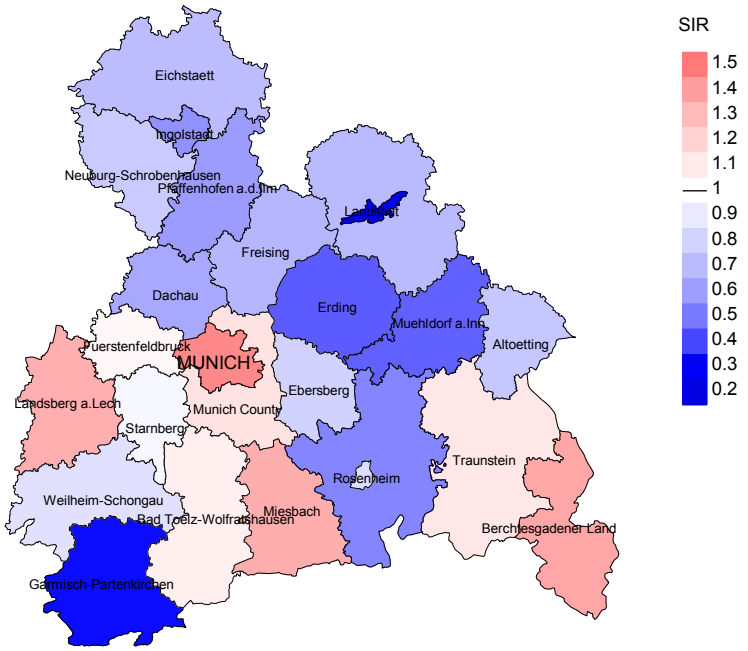


Figure 9a. Map of cancer incidence (world standard population, incl. DCO cases) by county averaged for period 2007 to 2014. According to their individual incidence rates, the counties are displayed in different red and blue color temperatures where the fine white color indicates the population mean (males 0.8/100,000 WS N=263, females 1.3/100,000 WS N=495).

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 65,347 female residents (averaged) in the period from 2007 to 2014 a total of 8 women were identified with newly diagnosed anal cancer. Therefore, the mean incidence rate for this cancer type in this area can be calculated at 0.9/100,000 (world standard population). Though, the value of this parameter may vary with an underlying probability of 99% between 0.3 and 2.3/100,000.

Standardized incidence ratio (SIR) 2007 - 2014: Males



Standardized incidence ratio (SIR) 2007 - 2014: Females

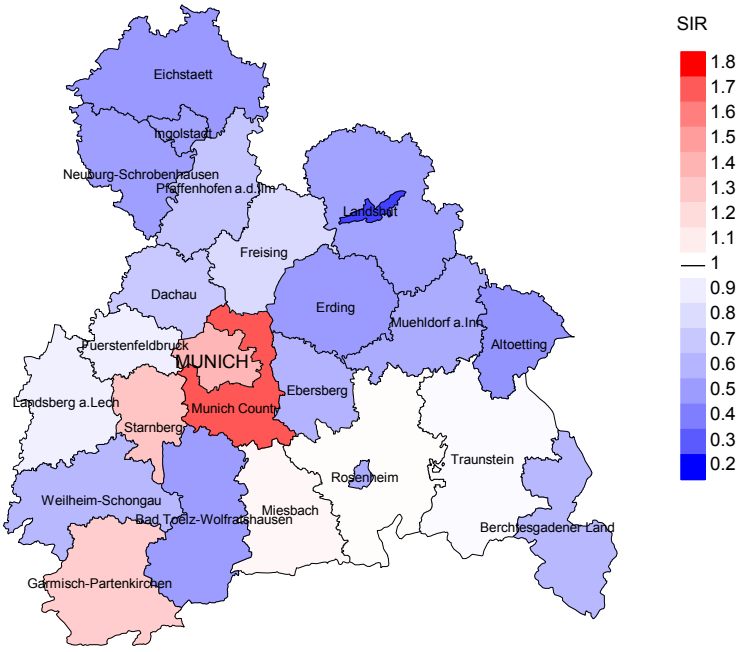


Figure 9b. Map of standardized incidence ratio (SIR, incl. DCO cases) by county averaged for period 2007 to 2014. According to their individual SIR values, the counties are displayed in different red and blue color temperatures where the fine white color indicates the population overall of 1.0 (males N=263, females N=495).

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 64,924 female residents (averaged) in the period from 2007 to 2014 a total of 8 women were identified with newly diagnosed anal cancer. Therefore, the mean standardized incidence ratio (SIR) for this cancer type in this area can be calculated at 0.60. Though, the value of this parameter may vary with an underlying probability of 99% between 0.19 and 1.39, and is therefore not statistically striking.

MORTALITY

Table 10a

Patient cohorts of incident cancers by year of diagnosis, follow-up status, proportion of DCO, deaths among the annual cohorts and proportion of available death certificates (with respect to registry area expansion from 2.51 to 3.96 m as of 2002, and from 3.96 to 4.64 m as of 2007, respectively)

Year of diagnosis	Incident cases n	Prop. actively followed %	Prop. DCO %	Deaths n	Prop. deaths %	Prop. deaths with death certific. %
1998	45	97.8		28	62.2	89.3
1999	33	97.0	9.1	20	60.6	90.0
2000	41	97.6		27	65.9	96.3
2001	56	94.6	5.4	35	62.5	97.1
2002	65	98.5	3.1	44	67.7	97.7
2003	67	92.5	1.5	30	44.8	100.0
2004	71	97.2	4.2	28	39.4	100.0
2005	76	94.7	1.3	44	57.9	97.7
2006	80	93.8	5.0	40	50.0	100.0
2007	94	78.7	4.3	50	53.2	98.0
2008	87	79.3	1.1	41	47.1	100.0
2009	111	76.6	0.9	43	38.7	97.7
2010	117	76.1	5.1	55	47.0	96.4
2011	102	75.5	1.0	35	34.3	94.3
2012	105	78.1		33	31.4	93.9
2013	90	98.9		15	16.7	100.0
2014	52	98.1	7.7	10	19.2	70.0
1998-2014	1292	87.2	2.6	578	44.7	96.5

Table 10b

Annual cohorts of incident cancers and deaths, proportion of death certificates and cases deceased the same year of cancer diagnosis
(incl. DCO)
(with respect to registry area expansion from 2.51 to 3.96 m as of 2002, and from 3.96 to 4.64 m as of 2007, respectively)

Year of diagnosis/ death	Incident cases n	Deaths n	Prop. deaths with death certific. %	Deaths in same year n	Prop. deaths in same year %
1998	45	13	84.6	4	8.9
1999	33	12	83.3	1	3.0
2000	41	19	84.2	4	9.8
2001	56	29	96.6	8	14.3
2002	65	35	97.1	8	12.3
2003	67	29	100.0	5	7.5
2004	71	34	100.0	5	7.0
2005	76	48	95.8	10	13.2
2006	80	44	100.0	6	7.5
2007	94	48	93.8	8	8.5
2008	87	43	97.7	6	6.9
2009	111	42	100.0	4	3.6
2010	117	70	100.0	20	17.1
2011	102	71	97.2	10	9.8
2012	105	58	100.0	11	10.5
2013	90	51	100.0	5	5.6
2014	52	52	94.2	6	11.5
1998-2014	1292	698	97.1	121	9.4

Table 10c

Annual cohorts of deaths, proportion of cancer-related and non-cancer-related deaths, and cancer recorded on death certificates (incl. DCO)
(with respect to registry area expansion from 2.51 to 3.96 m as of 2002, and from 3.96 to 4.64 m as of 2007, respectively)

Year of death	Deaths n	Prop. cancer-related %	Prop. non-cancer-related %	Prop. cancer recorded on death certificate %
1998	13	61.5	38.5	90.9
1999	12	41.7	58.3	80.0
2000	19	89.5	10.5	100.0
2001	29	62.1	37.9	85.7
2002	35	85.7	14.3	91.2
2003	29	82.8	17.2	89.7
2004	34	76.5	23.5	88.2
2005	48	83.3	16.7	91.3
2006	44	65.9	34.1	79.5
2007	48	64.6	35.4	80.0
2008	43	81.4	18.6	90.5
2009	42	69.0	31.0	92.9
2010	70	75.7	24.3	87.1
2011	71	81.7	18.3	89.9
2012	58	69.0	31.0	75.9
2013	51	62.7	37.3	70.6
2014	52	75.0	25.0	87.8
1998-2014	698	73.6	26.4	85.7

Table 11a

Medians of age at death according to the grouping in Table 10
MALES

Year of death	Deaths n	Age at death (all causes) Years	Age at death (cancer-related) Years	Age at death (non-cancer-related) Years	Age at death (according to death certificate) Years
1998	3	54.9	46.7	61.7	54.9
1999	3	59.9	62.8	58.9	62.8
2000	4	60.1	51.7	88.4	68.5
2001	12	75.3	74.7	82.1	75.8
2002	10	62.1	55.4	66.8	58.3
2003	11	63.5	60.4	76.5	61.9
2004	11	69.9	69.7	69.9	68.6
2005	16	70.1	70.1	74.9	70.1
2006	15	63.5	63.3	65.6	63.4
2007	15	71.6	70.5	71.6	71.8
2008	14	69.7	69.7	69.0	70.2
2009	10	70.9	66.6	80.9	68.9
2010	31	69.0	70.8	63.4	70.8
2011	24	72.3	72.3	67.6	72.0
2012	19	74.0	71.2	83.1	75.2
2013	23	80.1	72.8	86.3	72.8
2014	18	66.2	65.1	79.2	65.1
1998-2014	239	69.1	68.5	72.9	69.1

Deaths of patients are considered to be cancer-related, in case that fact was recorded on the death certificate, or patients had suffered from metastasis or recurrence.

Table 11b

Medians of age at death according to the grouping in Table 10
FEMALES

Year of death	Deaths n	Age at death (all causes) Years	Age at death (cancer-related) Years	Age at death (non-cancer-related) Years	Age at death (according to death certificate) Years
1998	10	77.7	59.6	86.4	72.5
1999	9	86.9	75.5	87.8	77.7
2000	15	80.3	80.4	34.8	80.3
2001	17	82.9	78.7	85.8	82.9
2002	25	81.9	82.1	60.4	82.1
2003	18	82.0	81.8	89.3	82.0
2004	23	83.2	77.2	91.9	81.6
2005	32	80.0	80.0	83.0	80.0
2006	29	80.0	80.3	80.0	80.0
2007	33	80.0	76.2	84.5	77.8
2008	29	81.6	80.7	84.5	80.9
2009	32	74.6	73.6	80.8	74.0
2010	39	83.3	79.8	85.8	83.3
2011	47	75.6	73.7	85.1	74.3
2012	39	79.6	77.3	86.5	77.7
2013	28	80.6	79.2	85.7	80.6
2014	34	74.0	70.7	82.4	72.7
1998-2014	459	80.4	77.3	85.7	79.1

By 2010, life expectancy at birth was 77.5 years for boys and 82.6 years for girls.

Deaths of patients are considered to be cancer-related, in case that fact was recorded on the death certificate, or patients had suffered from metastasis or recurrence.

Table 12a

Mortality measures (cancer-related death) and mortality-incidence-index
by year of death
MALES

Year of death	Deaths n	Mort. raw	MI-Index raw	Mort. WS	MI-Index WS	Mort. ES	MI-Index ES	Mort. BRD-S	MI-Index BRD-S
1998	1	0.1	0.07	0.1	0.10	0.1	0.08	0.1	0.08
1999	1	0.1	0.10	0.1	0.10	0.1	0.08	0.1	0.07
2000	3	0.3	0.27	0.2	0.35	0.3	0.32	0.3	0.29
2001	9	0.8	0.43	0.4	0.41	0.7	0.48	1.0	0.54
2002	6	0.3	0.38	0.2	0.45	0.3	0.39	0.3	0.33
2003	9	0.5	0.43	0.3	0.43	0.4	0.40	0.5	0.40
2004	8	0.4	0.50	0.2	0.40	0.3	0.45	0.5	0.51
2005	12	0.6	0.75	0.3	0.61	0.5	0.64	0.6	0.73
2006	9	0.5	0.35	0.3	0.36	0.4	0.39	0.5	0.41
2007	8	0.4	0.24	0.2	0.22	0.3	0.23	0.3	0.22
2008	12	0.5	0.44	0.3	0.39	0.4	0.42	0.5	0.46
2009	6	0.3	0.15	0.1	0.14	0.2	0.14	0.2	0.14
2010	25	1.1	0.66	0.5	0.66	0.8	0.67	1.0	0.65
2011	20	0.9	0.49	0.4	0.43	0.7	0.46	0.9	0.51
2012	15	0.7	0.52	0.3	0.54	0.5	0.54	0.6	0.53
2013	14	0.6	0.40	0.3	0.29	0.4	0.32	0.5	0.39
2014	16	0.7	0.89	0.4	0.93	0.6	0.96	0.7	0.99
1998-2014	174	0.5	0.42	0.3	0.39	0.4	0.41	0.5	0.43

Table 12b

Mortality measures (cancer-related death) and mortality-incidence-index
by year of death
FEMALES

Year of death	Deaths n	Mort. raw	MI-Index raw	Mort. WS	MI-Index WS	Mort. ES	MI-Index ES	Mort. BRD-S	MI-Index BRD-S
1998	7	0.6	0.23	0.3	0.20	0.4	0.21	0.5	0.21
1999	4	0.3	0.17	0.1	0.15	0.2	0.17	0.3	0.18
2000	14	1.2	0.47	0.4	0.31	0.7	0.35	0.9	0.43
2001	9	0.7	0.26	0.3	0.20	0.5	0.22	0.6	0.25
2002	24	1.2	0.49	0.4	0.32	0.7	0.36	0.9	0.42
2003	15	0.8	0.33	0.2	0.19	0.4	0.23	0.5	0.27
2004	18	0.9	0.33	0.4	0.26	0.6	0.29	0.7	0.29
2005	28	1.4	0.47	0.5	0.35	0.8	0.38	1.1	0.42
2006	20	1.0	0.37	0.4	0.26	0.6	0.28	0.8	0.32
2007	23	1.0	0.38	0.4	0.34	0.6	0.35	0.8	0.36
2008	23	1.0	0.38	0.3	0.26	0.5	0.29	0.7	0.35
2009	23	1.0	0.33	0.4	0.23	0.6	0.26	0.7	0.28
2010	28	1.2	0.35	0.5	0.28	0.7	0.29	0.8	0.30
2011	38	1.6	0.62	0.6	0.44	0.9	0.49	1.2	0.53
2012	25	1.1	0.33	0.4	0.23	0.6	0.25	0.8	0.29
2013	18	0.8	0.33	0.2	0.21	0.4	0.23	0.6	0.29
2014	23	1.0	0.68	0.4	0.51	0.6	0.59	0.7	0.61
1998-2014	340	1.0	0.39	0.4	0.28	0.6	0.31	0.8	0.34

Table 13

Age distribution of age at death (cancer-related) for period 2007-2014
(**incl. multiple primaries**)

Age at death Years	Cases n	%	Cum.%	Males n	%	Cum.%	Females n	%	Cum.%
40-44	4	1.3	1.3	1	0.9	0.9	3	1.5	1.5
45-49	14	4.4	5.7	4	3.4	4.3	10	5.0	6.5
50-54	13	4.1	9.8	6	5.2	9.5	7	3.5	10.0
55-59	26	8.2	18.0	13	11.2	20.7	13	6.5	16.4
60-64	31	9.8	27.8	13	11.2	31.9	18	9.0	25.4
65-69	37	11.7	39.4	19	16.4	48.3	18	9.0	34.3
70-74	50	15.8	55.2	21	18.1	66.4	29	14.4	48.8
75-79	38	12.0	67.2	16	13.8	80.2	22	10.9	59.7
80-84	36	11.4	78.5	11	9.5	89.7	25	12.4	72.1
85+	68	21.5	100.0	12	10.3	100.0	56	27.9	100.0
All ages	317	100.0		116	100.0		201	100.0	

Included in the statistics are 36.5% multiple primaries in males and 40.6% in females.

Table 14

Age-specific mortality (cancer-related) and proportion of all cancers
for period 2007-2014
(**incl. multiple primaries**)

Age at death Years	Males n	Females n	Males Age-spec. mortal.	Males MI-index	Females Age-spec. mortal.	Females MI-index	Males Prop.all cancers %	Females Prop.all cancers %
0- 4			0.0		0.0			
5- 9			0.0		0.0			
10-14			0.0		0.0			
15-19			0.0		0.0			
20-24			0.0		0.0			
25-29			0.0		0.0			
30-34			0.0		0.0			
35-39			0.0		0.0			
40-44	1	3	0.1	0.10	0.2	0.15	0.2	0.5
45-49	4	10	0.3	0.19	0.7	0.29	0.4	0.8
50-54	6	7	0.5	0.22	0.5	0.13	0.3	0.4
55-59	13	13	1.2	0.39	1.2	0.25	0.4	0.5
60-64	13	18	1.3	0.57	1.7	0.30	0.3	0.5
65-69	19	18	2.0	0.46	1.7	0.33	0.3	0.3
70-74	21	29	2.3	0.58	2.8	0.55	0.2	0.4
75-79	16	22	2.9	0.52	3.1	0.44	0.2	0.4
80-84	11	25	3.1	0.58	4.5	0.61	0.1	0.4
85+	12	56	5.2	0.75	9.7	0.90	0.2	0.6
All ages	116	201					0.2	0.5
Mortality								
Raw			0.6	0.44	1.1	0.41		
WS			0.3	0.40	0.4	0.30		
ES			0.5	0.42	0.6	0.32		
BRD-S			0.6	0.45	0.8	0.36		
PYLL-70								
per 100,000			3.3		4.9			
ES			2.9		4.0			
AYLL-70			9.5		11.2			

The rates underestimate the prognosis if other synchronous cancers are prognostic unfavorable.

Table 15a

Multiple primaries in deaths in period 1998-2014
MALES

Diagnosis		Total n	Total %↓	Pre n	Pre ←%	Syn-chron ±30d n	Syn-chron ±30d ←%	Post n	Post ←%
C03-C06	Oral cavity	1	1.3	1	100.0				
C09-C10	Oropharynx	3	3.9	1	33.3	1	33.3	1	33.3
C12-C13	Hypopharynx	2	2.6	1	50.0			1	50.0
C15	Oesophagus	4	5.2	2	50.0			2	50.0
C16	Stomach	4	5.2	1	25.0			3	75.0
C18	Colon	8	10.4	5	62.5			3	37.5
C19-C20	Rectum	6	7.8			2	33.3	4	66.7
C32	Larynx	1	1.3	1	100.0				
C33-C34	Lung	12	15.6	1	8.3	3	25.0	8	66.7
C43	Malign. melanoma	2	2.6	1	50.0			1	50.0
C44	Skin others	6	7.8	2	33.3	1	16.7	3	50.0
C60	Penis	1	1.3	1	100.0				
C61	Prostate	9	11.7	4	44.4	1	11.1	4	44.4
C62	Testis	1	1.3	1	100.0				
C64	Kidney	1	1.3	1	100.0				
C65	Renal pelvis	1	1.3					1	100.0
C67	Bladder	5	6.5	3	60.0	1	20.0	1	20.0
C70-C72	CNS cancer	3	3.9	1	33.3	1	33.3	1	33.3
C73	Thyroid	1	1.3	1	100.0				
C81	Hodgkin lymphoma	1	1.3	1	100.0				
C82-C85	NHL	3	3.9	2	66.7			1	33.3
C90	Mult. myeloma	1	1.3	1	100.0				
C91-C96	Leukaemia	1	1.3					1	100.0
All mult. primaries		77	100.0	32	41.6	10	13.0	35	45.5

ICD-10 C44 (Other malignant neoplasms of skin) is not systematically recorded by MCR and therefore not considered for evaluation as a particular primary but at least as a multiple malignancy.

Table 15b

Multiple primaries in deaths in period 1998-2014
FEMALES

Diagnosis		Total n	Total %↓	Pre n	Pre ←%	Syn-chron ±30d n	Syn-chron ±30d ←%	Post n	Post ←%
C03-C06	Oral cavity	3	1.6	3	100.0				
C09-C10	Oropharynx	3	1.6	1	33.3			2	66.7
C15	Oesophagus	2	1.1			1	50.0	1	50.0
C16	Stomach	8	4.4	1	12.5	1	12.5	6	75.0
C18	Colon	20	11.0	6	30.0	2	10.0	12	60.0
C19-C20	Rectum	6	3.3	1	16.7	4	66.7	1	16.7
C21	Anus/canal	2	1.1			1	50.0	1	50.0
C25	Pancreas	3	1.6					3	100.0
C33-C34	Lung	23	12.6	3	13.0	3	13.0	17	73.9
C43	Malign. melanoma	3	1.6	2	66.7			1	33.3
C44	Skin others	7	3.8	2	28.6			5	71.4
C50	Breast	25	13.7	13	52.0	5	20.0	7	28.0
C51	Vulva	9	4.9	4	44.4			5	55.6
C52	Vagina	2	1.1	2	100.0				
C53	Cervix uteri	18	9.9	16	88.9			2	11.1
C54	Corpus uteri	6	3.3	2	33.3			4	66.7
C56	Ovary	2	1.1	2	100.0				
C64	Kidney	2	1.1	1	50.0	1	50.0		
C67	Bladder	3	1.6	2	66.7			1	33.3
C70-C72	CNS cancer	4	2.2	1	25.0	1	25.0	2	50.0
C73	Thyroid	4	2.2					4	100.0
C76-C79	CUP	2	1.1					2	100.0
C82-C85	NHL	10	5.5	6	60.0			4	40.0
C90	Mult. myeloma	3	1.6	1	33.3			2	66.7
C91-C96	Leukaemia	7	3.8	2	28.6			5	71.4
Other primaries		5	2.7	1	20.0			4	80.0
All mult. primaries		182	100.0	72	39.6	19	10.4	91	50.0

Multiple primaries with number of cases 1 are pooled in category “Other primaries”

ICD-10 C44 (Other malignant neoplasms of skin) is not systematically recorded by MCR and therefore not considered for evaluation as a particular primary but at least as a multiple malignancy.

Table 16

Age-specific mortality (cancer-related) and proportion of all cancers
for period 2007-2014
(**First primaries only** *)

Age at death Years	Males n	Females n	Males Age-spec. mortal.	Males MI-index	Females Age-spec. mortal.	Females MI-index	Males Prop.all cancers %	Females Prop.all cancers %
0- 4			0.0		0.0			
5- 9			0.0		0.0			
10-14			0.0		0.0			
15-19			0.0		0.0			
20-24			0.0		0.0			
25-29			0.0		0.0			
30-34			0.0		0.0			
35-39			0.0		0.0			
40-44	1	2	0.1	0.10	0.1	0.12	0.2	0.4
45-49	3	9	0.2	0.17	0.6	0.29	0.3	0.9
50-54	6	5	0.5	0.24	0.4	0.11	0.4	0.3
55-59	10	12	0.9	0.33	1.1	0.28	0.4	0.6
60-64	9	14	0.9	0.43	1.3	0.33	0.2	0.5
65-69	15	11	1.6	0.52	1.1	0.26	0.3	0.3
70-74	13	21	1.4	0.62	2.0	0.60	0.2	0.4
75-79	11	15	2.0	0.50	2.1	0.42	0.2	0.3
80-84	11	14	3.1	0.85	2.5	0.52	0.2	0.3
85+	10	42	4.3	0.83	7.3	0.88	0.2	0.6
All ages	89	145					0.2	0.4
Mortality								
Raw			0.5	0.43	0.8	0.38		
WS			0.2	0.38	0.3	0.28		
ES			0.4	0.40	0.5	0.31		
BRD-S			0.5	0.44	0.6	0.33		
PYLL-70								
per 100,000			2.7		4.0			
ES			2.4		3.3			
AYLL-70			9.8		11.8			

* See corresponding tables with multiple primaries.

Table 17

Age-specific mortality (cancer-related) and proportion of all cancers
for period 2007-2014
(**Single primaries only** *)

Age at death Years	Males n	Females n	Males Age-spec. mortal.	Males MI-index	Females Age-spec. mortal.	Females MI-index	Males Prop.all cancers %	Females Prop.all cancers %
0- 4			0.0		0.0			
5- 9			0.0		0.0			
10-14			0.0		0.0			
15-19			0.0		0.0			
20-24			0.0		0.0			
25-29			0.0		0.0			
30-34			0.0		0.0			
35-39			0.0		0.0			
40-44	1	1	0.1	0.11	0.1	0.06	0.3	0.2
45-49	2	9	0.1	0.13	0.6	0.30	0.2	1.0
50-54	5	5	0.4	0.21	0.4	0.13	0.3	0.4
55-59	8	8	0.8	0.31	0.7	0.21	0.3	0.4
60-64	4	10	0.4	0.20	0.9	0.27	0.1	0.4
65-69	13	9	1.4	0.50	0.9	0.23	0.3	0.3
70-74	7	16	0.8	0.35	1.5	0.48	0.1	0.4
75-79	11	12	2.0	0.52	1.7	0.35	0.2	0.3
80-84	9	10	2.6	0.75	1.8	0.43	0.2	0.2
85+	10	32	4.3	0.83	5.5	0.71	0.3	0.6
All ages	70	112					0.2	0.4
Mortality								
Raw			0.4	0.36	0.6	0.32		
WS			0.2	0.31	0.2	0.24		
ES			0.3	0.34	0.4	0.26		
BRD-S			0.4	0.38	0.4	0.29		
PYLL-70								
per 100,000			2.0		3.3			
ES			1.8		2.7			
AYLL-70			9.8		12.3			

* See corresponding tables with multiple primaries.

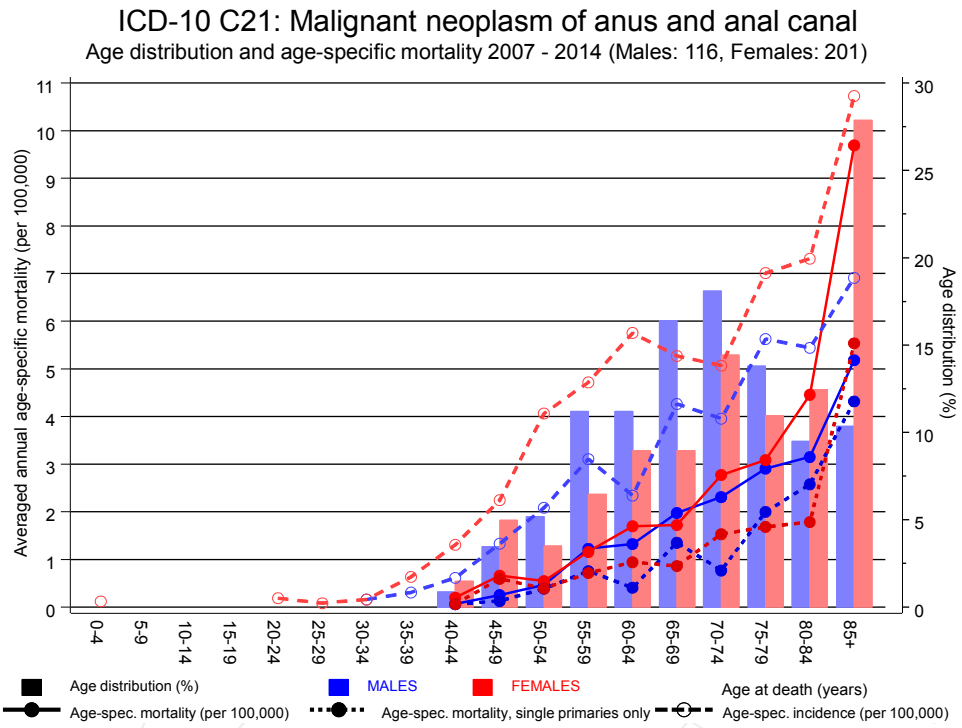
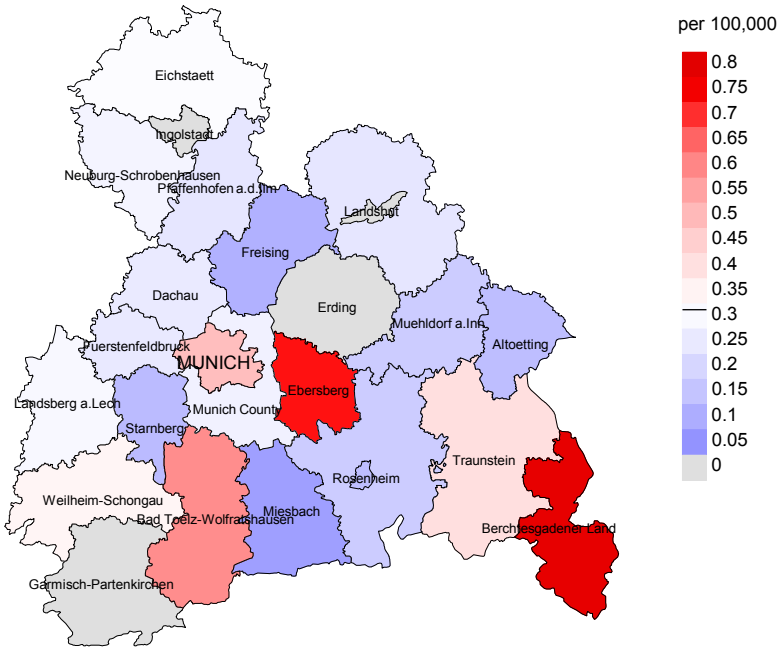


Figure 18. Distribution of age at death (bars) and age-specific mortality (all patients: solid line, patients with single primaries: dotted line). The age-specific incidence is additionally plotted for comparison (dashed line).

The difference between age at diagnosis (Table 3) and age at anal cancer-related death (see Table 10) should be considered.

Average mortality (world standard population) 2007 - 2014: Males



Average mortality (world standard population) 2007 - 2014: Females

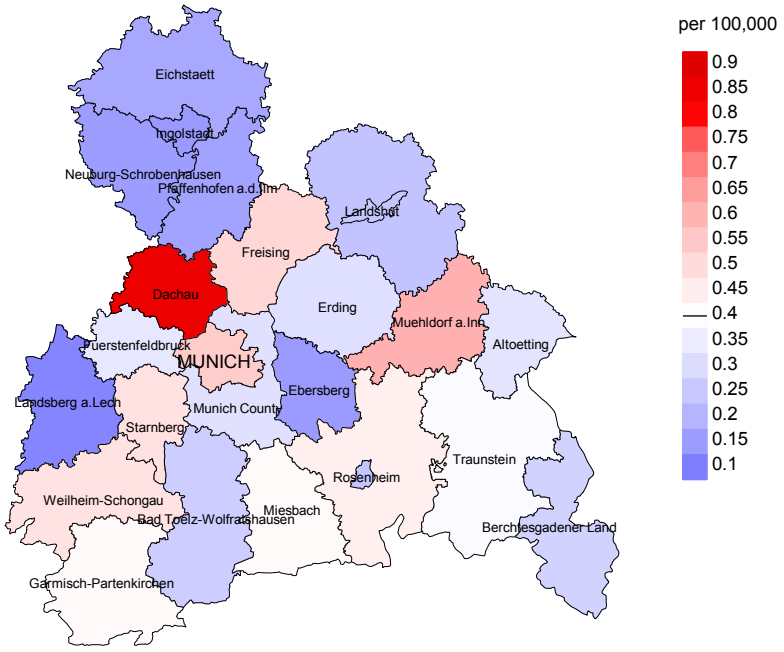
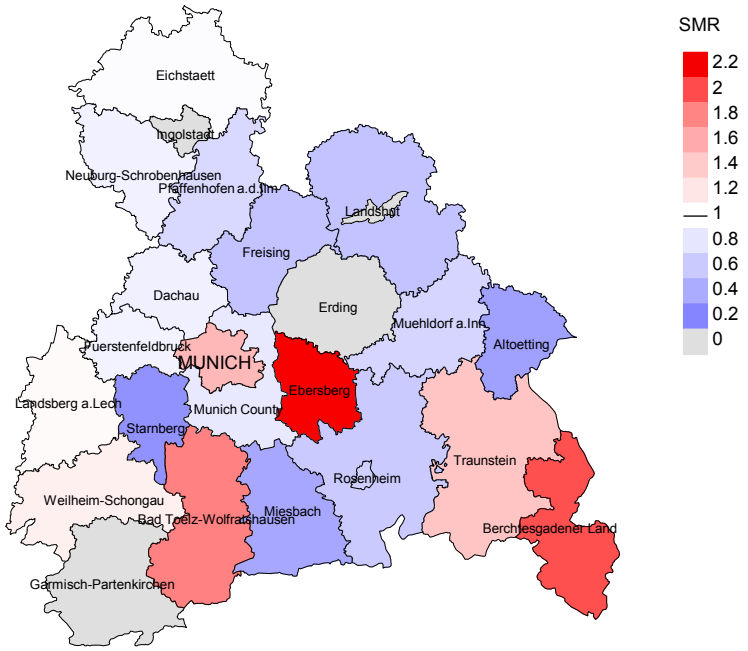


Figure 19a. Map of cancer mortality (world standard population) by county averaged for period 2007 to 2014. According to their individual mortality rates, the counties are displayed in different red and blue color temperatures where the fine white color indicates the population mean (males 0.3/100,000 WS N=115, females 0.4/100,000 WS N=200).

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 65,347 female residents (averaged) in the period from 2007 to 2014 a total of 2 women died from anal cancer. Therefore, the mean mortality rate for this cancer type in this area can be calculated at 0.1/100,000 (world standard population). Though, the value of this parameter may vary with an underlying probability of 99% between 0.0 and 0.7/100,000.

Standardized mortality ratio (SMR) 2007 - 2014: Males



Standardized mortality ratio (SMR) 2007 - 2014: Females

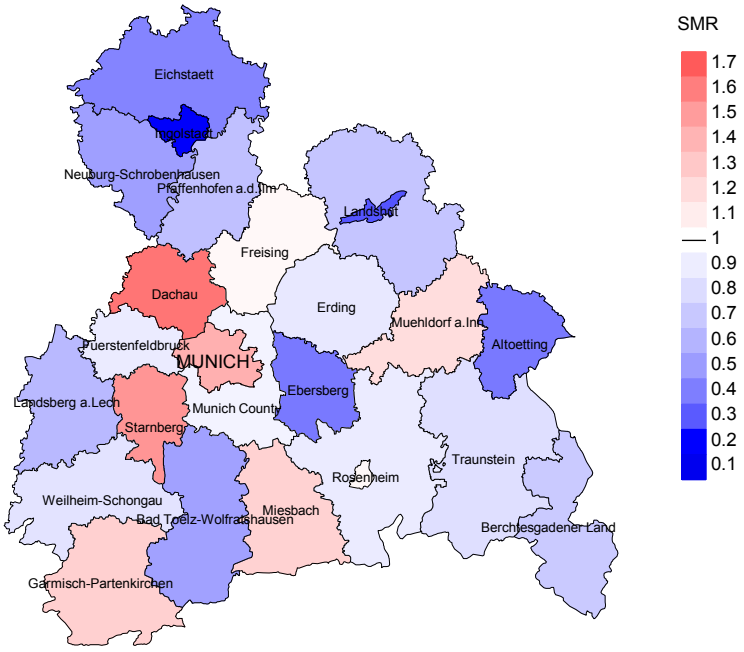


Figure 19b. Map of standardized mortality ratio (SMR, incl. DCO cases) by county averaged for period 2007 to 2014. According to their individual SMR values, the counties are displayed in different red and blue color temperatures where the fine white color indicates the population overall of 1.0 (males N=115, females N=200).

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 64,924 female residents (averaged) in the period from 2007 to 2014 a total of 2 women died from anal cancer. Therefore, the mean standardized mortality ratio (SMR) for this cancer type in this area can be calculated at 0.38. Though, the value of this parameter may vary with an underlying probability of 99% between 0.02 and 1.78, and is therefore not statistically striking.

Statistical Notes

In all tables and figures the respective reference values should be carefully considered. The incidence rates include diagnoses (with multiple primary), and death certificate only (DCO) cases, where applicable. For mortality statistics patients, diagnoses and progressive course of disease are presented. In the calculations, all courses of disease are considered whereby progressions occurred and/or death certificate identified progressive cancers were ascertained. Additionally there are three groups of disease course to consider:

1. **All multiple primaries included**

   The mortality statistic describes the tumor-specific death, independent of any malignancy. The patient perspective, induced secondary malignancies, and the problem of multiple malignancies from the same primary tumor all have reasons for their inclusion.

2. **First singular primary** (no information about other prior or synchronous malignancy)

   The mortality statistic describes the cancer-related death for patients who have no therapeutic restrictions due to a previous or synchronous cancer. These statistics are comparable to studies that have exclusion criteria based on a second malignancy.

3. **Single primary** (no information about other prior, syn- or metachronous malignancy)

   The mortality statistic describes the tumor-specific death that occurs without any impact through secondary primaries, earlier, synchronous, later or induced. Precisely the difference between disease group 1 and 2 highlight the magnitude of the problem of secondary malignancies.

For this reason differences appear concerning official mono-causal mortality statistics. To judge the maximum deviation, 2 further tables are presented. In the first table the distribution of secondary malignancies before, at or after the described cancer are shown, that could be an alternative cause of death. In the second table, the age-specific mortality rates for all courses of disease, without designation of secondary malignancies are shown.

A previously minimally acknowledged statistic is the **age at death**, which allows for a good assessment of the quality of classification of the apparent tumor-specific death. For assumed tumor-independent deaths, the age of death should be estimated from the age of diagnosis and the normal life expectancy, whereas tumor-dependent deaths can be estimated from the age of diagnosis plus the average tumor-specific life expectancy. The comparison of different tumors demonstrates this association, if the causes of cancer and the competing cause of death are independent of each other (e.g. breast and colon versus head/neck and lung).

The index from mortality and incidence (Mortality-Incidence ratio, **MI-index**) is a statistic that allows for the evaluation of the quality of data. For diseases with poor prognoses, comparable values are obtained from all age groups, because to a large extent, the numerator and denominator contain the same cases. For tumors with a good prognosis, increasing and decreasing incidence and age-specific differences in prognosis can more strongly alter the MI- index. Additionally, attention should be paid to the confidence intervals where fewer cases are reported.

The complexity of problems identified here emphasizes the importance of relative survival data for the appropriate analysis of long term results.

As a measurement of the burden of disease, the number of potential life years loss due to premature deaths in a cohort can be calculated (**PYLL**, potential years of life lost, standardized per 100,000 persons or per European standard) as well as the average loss of life years per individual (**AYLL**, average years of life lost). Depending upon the analytic aim (health economy, prevention, health care research) different methods exist for the generation of these measurements. In the results presented here, the age for a premature death is considered to be before 70 years, according to the guidelines of the OECD and the WHO (as seen in the abbreviation PYLL-70 or AYLL-70).

Shortcuts

FRG	Federal Republic of Germany
GEKID	Association of Population-based Cancer Registries in Germany (Gesellschaft der epidemiologischen Krebsregister in Deutschland e.V.)
MCR	Munich Cancer Registry (Tumorregister München)
SEER	Surveillance, Epidemiology, and End Results (USA)
AYLL-70	Average years of life lost prior to age 70 given a person dies before that age
BRD-S	German standard population
DCO	Death certificate only
EAR	Excess absolute risk = excess cancer cases (O - E) per 10,000 person-years
ES	European standard population (old)
LCL	Lower confidence limit
MI-index	Ratio between mortality and incidence
PYLL-70	Potential years of life lost prior to age 70 given a person dies before that age
SIR	Standardized incidence ratio
SMR	Standardized mortality ratio
UCL	Upper confidence limit
WS	World standard population

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